



## SAN BERNARDINO MICROWAVE SOCIETY, Incorporated

FOUNDED IN 1966

A NON-PROFIT AMATEUR TECHNICAL ORGANIZATION DEDICATED  
TO THE ADVANCEMENT OF COMMUNICATIONS ABOVE 1000 MC.

### W6IFE Newsletter

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The **3 January** 2002 meeting of the SBMS will have a talk by Chip N6CA on Dish Evaluation with a Laser Pointer. The SBMS meets at the American Legion Hall 1024 Main Street (south of the 91 freeway) in Corona, CA at 1900 hours local time on the first Thursday of each month. Check out the SBMS web site at <http://www.ham-radio.com/sbms/>.

**Prez Sez-** Happy 2002! This should be an outstanding year for microwave activity of all sorts. The Japanese have just announced a new record on 75 GHz, there was a new record for 241 and 322 GHz, which all point to a lot more equipment available and activity taking place on millimeter bands. In addition, there is a large amount of activity on 10GHz. 24GHz that will soon accelerate thanks to the work our club members are doing on the surplus equipment. (Check out Dave and Sam's report in this issue) I am amazed at the level of activity all around our own club. We are mostly a building club anyway but it seems like we are at a fever pitch with members getting test equipment and building on several bands. I'm encouraging a friend to put his 30 foot dish and 500w TWT on 3.5 GHz so our members can do EME with horn antennas. As impossible as that may sound the numbers are good and all the guy needs is some elliptical waveguide; he has the experience and equipment.

We may also see a significant number of our own club members above the 30 watt output level on 10GHz this year.

This is an exciting time and we can either watch it happen or be part of the action. What I mean is, that since so many people are working- get involved. With lots going on, there is lots to share and be part of. Now is the chance to become part of what we will look back on as a wonderful time. Remember that the effort each of us puts into projects, sharing work, results and operating will become synergistic to the whole club and the effect will be more than the sum of the parts. Get parts, get help, shoot the engineer and get on; then perfect it.

January Activity Day- We are planning to get out for the Jan VHF Sweepstakes contest and get on the air on Microwaves during the contest. Send an email on the reflector if you have definite plans or call me or Dave WA6CGR if you want to get on and work us. We will also take a poll at the Jan meeting to see who is going where and put it on the reflector. Should be a good time to check out our rigs and progress on how they are doing.

Here is a Thought for the September 10GHz and Up Contest: Especially for all the new operators on 24 GHz. We could have a party in the Mojave. With stations on Heap's, Blueridge, Walt's point, a group of rovers and others we could have a wonderful time operating. In September the Mojave is very dry and not too hot. It is a fairly confined area with good views in many directions. With the rigs we have for 10 and 24 GHz and using a special liaison frequency we could have a ball operating. From my experience there is almost no spot you could go to on a good day and not work stations easily. It will be a good time and place to operate on 24 GHz especially. In addition the stopping places to operate in the Mojave are well documented by Chuck and Bill, so the effort will be worth it. I suggest this as opposed to using Signal Hill and the LA basin because it is too easy to get wiped out by moisture on 24 GHz. In the last four years I have had much better results in the Mojave. In addition, it will give new operators a cinch operating environment to test out their new 24 GHz narrow band rigs. Any thoughts?

This month's meeting: Chip will review his dish accuracy measurement technique. Bring a dish and get it tested! (You will need to be able to remove the feed.)

Let me know if you have any requests for programs for our meetings or have any resources.

Doug Millar K6JEY

### 2002 Scheduling.

January 3, 1650Z - Quadrantids meteor shower

January 19-21, 1900Z-0400Z - ARRL January VHF Sweepstakes

7 February-- 24 GHz status review. Presentation by various members on the status of their 24 GHz stations. Frequency and power measurement test set-ups will be available for member's radios.

Banquet at the Guasti Cafe. With white elephant exchange and door prizes! (And good food)

7 March-- Noise Figure seminar- review of techniques with testing available through 24 GHz.

April-May, dates TBA, Spring Sprints

April 22, 1030Z - Lyrids meteor shower

May 17-19 - Dayton Hamfest

June 8-10, 1800Z - 0300Z - ARRL June VHF QSO Party

August 3-4, 1800Z - 1800Z - ARRL UHF Contest

August 12, 1720Z - Perseids meteor shower

August 17-18, 8 AM - 8 PM - ARRL 10-GHz Cumulative Contest

September 14-16, 1800Z - 0300Z - ARRL September VHF QSO Party

September 21-22, 8 AM-8 PM - ARRL 10-GHz Cumulative Contest

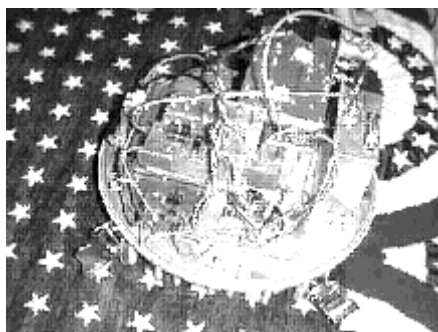
Sept-Oct, dates TBA, Fall Sprints

October 24-27 - Microwave Update 2002/Eastern VHF-UHF combined Conference sponsored by N.E.W.S.

November 19, 0040Z - Leonids meteor shower

December 14, 1000Z - Geminids meteor shower

**More on the P-Comm unit conversion project.** Photos added by WA6QYR from the December SBMS meeting.

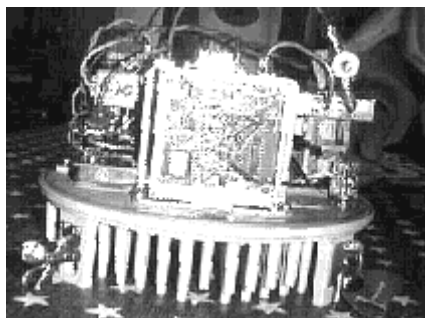


To all SBMS, As promised, here is some background and the latest update for the 24 GHz P-Com conversion project:

1. The Project - The goal of this project is to modify P-Com 23 GHz Tel-Link Out Door Units (ODU's) to Amateur 24 GHz SSB transverters while maintaining the original case and antenna mounting configuration.
2. The ODU - The P-Com Out Door Unit consists of an IF Processor, a Power Supply which receives -48 volts from the IF Processor, a Synthesizer, a Receive Module, a Transmit Module (rated at either +16 dBm or +21 dBm at 23 GHz) and an antenna Diplexer. The P-Com ODU is approximately 12" in diameter and about 12" high. These particular units were manufactured by REMEC in San Diego, CA.

It has two coax connectors, a type 'N' connector which normally connects the ODU to any of a series of P-Com InDoor Units (IDU's) through up to 150' of 9913 50 Ohm coax. The IDU's generate a transmit IF of about 300 MHz, have a receive IF of 140 MHz and provide -48 volts to the ODU all through the 9913 coax. This coax cable is called an IFL or Inter Facility Link cable. The other coax connector on the ODU is a 'BNC' connector which serves as the 'RSSI' or Receive Signal Strength Indicator (S-Meter) connector.

The antenna attaches to the ODU via 4 'latches' on the ODU.



The ODU has an antenna 'port' which is a 3/8" circular waveguide port that mates to the antenna's circular waveguide connector. The (optional) matching 2 foot P-Com dish antennas contain the feed and radome and come with a mounting bracket that will mount to 2" to 4" pipes.

The power supply converts the -48 volts (referenced to the ODU chassis) to +12, +5 and -5 volts. The output of the power supply connects back to the IF processor module which provides a central connector bank that feeds all of the other modules.

The synthesizer modules have variations among the units we have seen (about 25) in that some are high side local oscillators in the 21 GHz units and low side local oscillators in the 23 GHz units. The low frequency units are in the range of 9.6 GHz and the high frequency units are in the 12 GHz range. The units are originally designed to operate in 84 channels spaced at 7 MHz between channels.

The transmit and receive modules use surface mount devices which allows for easier modification. The original high IF frequency in the first modified unit was 3,775 MHz and the original output frequency was in the range of 23.012 GHz transmit and 22.004 GHz receive. The L.O. frequency applied to the transmit and receive module is 1/2 the actual operational L.O. frequency. The L.O. frequency is doubled in the transmit and receive modules.

The diplexer has a transmit/receive split of 1 GHz with circular waveguide antenna port and WR-42 waveguide input and output for the transmit and receive modules. There is a circulator between the diplexer and the transmit module as well as between the diplexer and the receive module.

The transmit and receive modules have WR-42 antenna ports and SMA connectors for the L.O. and I.F. ports.

3. The Plan - The agreed upon frequency configuration is as follows:

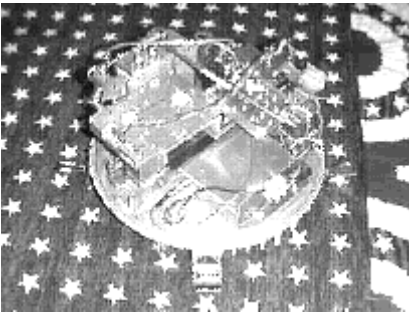
- a) The operating frequency is 24.192 GHz
- b) The Amateur I.F. frequency is 432.000 MHz
- c) The internal high I.F. frequency is 3.072 GHz
- d) The L.O. frequency is

The high I.F. frequency of 3.072 GHz was chosen so as not to have to move the transmit and receive module filters too far (from 3.775 GHz).

4. Progress to Date 11/16/2001 - Synthesizers -

The synthesizers in their original form have several problems that needed to be resolved. Specifically:

- a) The frequency stability of the synthesizer reference oscillator is rated at +/- 8 ppm! Not adequate for SSB use requiring less than 0.5 ppm. An external Qualcomm 10 MHz TCXO was chosen to replace the original TCXO.
- b) There was significant digital noise generated by communication between the I.F. processor and the synthesizer (exchanging channel information). This communication was disabled.
- c) The synthesizer loop filter is too slow causing slow lock-up and insufficient sideband suppression. This has been resolved by changing the loop component values.
- d) The synthesizer V.C.O. requires modification to increase the frequency to lock at the required output frequency of 10.560 GHz ( $24.192 \text{ GHz} - 3.072 \text{ GHz} = 21.120 \text{ GHz}$  divided by 2 = 10.560 GHz divided by 5 = the actual V.C.O. frequency of 2.112 GHz). Two capacitors were changed to bring the V.C.O. into range.



e) There is a proprietary protocol that the I.F. processor uses to communicate to the processor, so a standard MicroChip PIC 16F84A-04/P micro-controller was chosen to program the Motorola MC14515 synthesizer chip on power up. The loader program was written by Sam - K6VLM and provided to SBMS for this project. The new PIC 16F84A-04/P micro-controller board is now installed in the synthesizer box in the space vacated by the old TCXO.

f) The output amplifiers were re-tuned to produce an output power of 60+ mW, down about 10 mW from the original 70 mW L.O. output.

#### Transmit Module -

The transmit module required several modifications. The I.F. input circuit was modified to add a MAR-4 MMIC amplifier instead of the '420' programmable attenuator and biased appropriately. The I.F. filter was re-tuned to 3.072 GHz from 3.775 GHz. The L.O. doubler was re-tuned for a 10.560 GHz input/21.120 GHz output to the mixer. No re-tuning of the output filter was necessary. It was determined that the optimum voltage to the output GaAsFET's was +5 volts.

Success!! - With +7 dBm I.F. input at 3.072 GHz, the power output at 24.192 GHz was over 100 mW! The saturated power output was measured at 145 mW!

#### I.F. Processor Module -

This module is removed and is not used. Instead, a second converter module is built using a Qualcomm 3036/3236 Rectangular Synthesizer board (located at <http://www.ham-radio.com/sbms/sd/rplldoc1.htm>.)

programmed to 2.640 GHz, and a Mini-Circuits SKY-5G mixer to convert the 3.072 GHz I.F. to 432 MHz. The converter board (designed by K6VLM) uses a Pin Diode switch go between transmit and receive (no relays!). The Qualcomm 10 MHz TCXO is shared between the 2.640 GHz Qualcomm Synthesizer and the 10.560 GHz Synthesizer.

#### Receive Module -

The Receive Module has been finalized, the modification required was to modify the receive I.F. filter to 3.072 GHz and tune the multiplier.

#### Power Supply -

The original Power Supply is removed and will be replaced by a 12 volt input supply delivering all necessary voltages (+12, +5 and -5 volts).

#### 5. Next Steps -

First, to build the second prototype (the synthesizer is finished and the transmitter is about 50% complete) and complete the documentation and web site. Secondly, to put together kits and documentation to have a first run at building three systems by Doug - K6JEY, John - KJ6HZ, Kurt - K6RRA, Ken - WB6DTA and Bob - W6SYA.

Thirdly, to be able to provide kits (in a quantity buy to get better prices) to SBMS members who have already purchased P-Com units and want to get on 24 GHz SSB as soon as possible and to others later.

Sam - K6VLM has provided the engineering modifications, micro-controller programming and will be providing the final tuning modifications for the Receive Module as well as P.C. Board designs

for the micro-controller, second converter and transmit and receive power supply bias boards.

Dave - WA6CGR has provided the P-Com units (ODU's and Antennas) and will be providing the 2nd prototype and design verification, parts kits (including pre-programmed micro-controllers), SMD components (resistors, capacitors, micro-controller chips, SMD crystals, mixers, etc.), documentation (photos, conversion instructions, web site), etc.

## 6. Acknowledgements -

I would like to thank Sam - K6VLM for all of his continuous efforts, Hiro - KE6IDA, Doug, K6JEY, John - KJ6HZ, Kurt - K6RRA, Chuck - WB6IGP, Kerry - N6IZW (and I'm sure others) for their input, suggestions and putting up with us on the radio. This has been and will continue to be an exciting and intense SBMS project that everyone will be able to participate in!

Thanks, Dave - WA6CGR

Photos by WA6QYR at the December meeting.



At the pile of boxes center is Dave WA6CGR and Sam K6VLM during the December meeting where Dave had more P-Comm 23 GHz "land mine" boxes to sell and the indoor units. Both talked about the modifications to make the unit into a useful 24 GHz transverter. See the above document of status as of the end of November. Dave can be reached at WA6CGR@ ham-radio.com. WA6QYR photo.

Last meeting- John Hoot's (N6NHP) talk on "Practical Radio Astronomy at Microwave Frequencies" was super! Lots of viewgraphs and photographs showing what he is doing at the Benton, Az site along with some stuff that any SBMS member could do in listening to the universe. Thanks John. In addition to John there were more visitors: Chuck W7VX of Redondo Beach; John, KD6IOX of Pomona; and Gary, WA7BIP of Duarte. Welcome!

29 people attended the December SBMS meeting. There were lots of things to report on activities by everyone, but little space left in this newsletter to cover that. The Wants and Gots for sale sheet was misplaced at the meeting so that information isn't available to report.

As this goes to press (the Xerox machine at a local business) I would like to wish everyone a Merry Christmas and a Happy New Year.

73's Bill

Some of the older members of the Society had a good chat during the December 2001 meeting. Here from the left Ed, W6OYJ, George, K6MBL and Dick, K6HIJ discuss activities and what they have been doing. Photo by WA6QYR



The **San Bernardino Microwave Society** is a technical amateur radio club affiliated with the ARRL having a membership of over 90 amateurs from Hawaii and Alaska to the east coast. Dues are \$15 per year, which includes a badge and monthly newsletter. Your mail label indicates your call followed by when your dues are due. Dues can be sent to the treasurer as listed under the banner on the front page. If you have material you would like in the newsletter please send it to Bill WA6QYR at 247 Rebel Road Ridgecrest, CA 93555, [bburns@ridgecrest.ca.us](mailto:bburns@ridgecrest.ca.us), or phone 760-375-8566. The newsletter is generated about the 15th of the month and put into the mail at least the week prior to the meeting. This is your newsletter. SBMS Newsletter material can be copied as long as SBMS is identified as source.

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